Shedding a different light on the subject

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After a period of relative quiet, the blue end of the spectrum is coming back into the spotlight. We are used to Nichia suing other opto companies to defend its patents. A few years ago it took on Osram Opto Semiconductors but withdrew its filing. Recently Osram countered that Nichia has illegally used mixed-colour LEDs based on phosphors (see Issue 6, page 14). We can therefore expect such claims and counter-claims to continue for some time to come.

Stakes are high because they concern a multi-billion dollar market when all-solid-state white LEDs replace glass lamps. Companies like Osram (which are already leaders in the older industry) will then want to guarantee they continue to have a business (unlike the analogue watch companies that vanished due to the digital watch).

Similarly, the major players are announcing how they may position themselves in another revolutionary product area, that of high-density data storage (e.g. the solid-state VCR). Once again, at the centre of this arena is Nichia. But, while Nichia was already half-way to making white LEDs through its phosphor business, it is very new making and selling diode lasers for the consumer market.

Meanwhile, consumer electronics market leader Matsushita Electric made a surprise commitment itself to second-harmonic-generation lasers. The necessarily higher power and shorter wavelength are possible by using a high-powered wavelength-tunable infrared laser diode and then transforming infrared light into blue light. It claims that this is the first high-power, high-efficiency device ready for use in next-generation optical disc recording systems. It is smaller than previous packages and via its in-house-developed assembly techniques) claims lower noise and wavelength variation compared with GaN lasers.

Matsushita is not alone in pursuing the SHG approach, so one wonders if these companies are having to find an alternative route to the compact diode laser necessary for future consumer products. Given the vigour with which Nichia has defended its LED patents, this is not too surprising. Further, the Japanese companies which dominate the consumer optical storage market (i.e. CD, MD and DVD players) have traditionally preferred to have total control over engineering production so they can deliver the requisite mix of performance and price.

As a US example of the alternative approach, Coherent recently became the first to offer a commercial solid-state 460 nm blue laser. Based on its optically pumped semiconductor laser (OPSL) coupled with a VCSEL, it allows higher power than with electrical pumping. It is aimed not at the consumer market but at competing with air-cooled argon-ion lasers for instrumentation applications such as digital imaging systems and wafer inspection. The wavelength is chosen by varying the growth of the OPSL's semiconductor material.

We should note that developments in GaN/SiC are now not restricted to just opto. Several companies have committed to microelectronic components and launched commercial devices. Once again, Cree is one of the driving forces. Its GaN HEMTs and epiwafers have already been successfully installed aboard the *International Space Station* to determine their radiation hardness for future satellite applications. It also has a deal with Microsemi, which has produced the first in a series of commercial SiC Schottky diodes. These should be attractive to designers looking for performance advantages in smaller packages, as they offer the highest power and voltage combination in packages a quarter the size of those for conventional silicon devices.

This is where the strategies of the wide-bandgap pioneers diverge. Cree has been willing to share its technology and is developing electronic as well as opto devices. Meanwhile, if Nichia continues to refuse to licence its technology, device makers will have to either fight in the courts or develop their own alternatives like SHG. Either way, Nichia could ultimately lose out. It would be sad if - after all that ground-breaking work - it ended up on the sidelines.

If Nichia continues to refuse to licence its technology, device makers will have to pursue one of two routes - either fight in the courts or develop their own alternatives like SHG [second-harmonic generation]. Either way, Nichia could ultimately lose out financially.

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